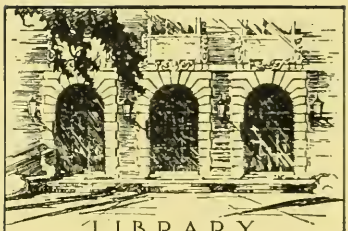

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WINDBREAKS

for Illinois Farmsteads

J. E. Davis

Circular 38

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WINDBREAKS
For Illinois Farmsteads

J. E. Davis

Printed by Authority of the State of Illinois

NATURAL HISTORY SURVEY DIVISION
Theodore H. Frison, Chief

Circular 38 Urbana December 1940

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The greatest benefit that can be expected from a good windbreak is the sheltering effect on the farmhouse, the farm buildings and the feedlots. With its contribution of beauty and color, as well as comfort, the windbreak can make a farm home out of a farmhouse. The red cedar windbreak illustrated here is in Fulton County.

WINDBREAKS . J. E. DAVIS*

For Illinois Farmsteads

WINDBREAK, as commonly understood in Illinois, is the name given to a narrow belt of trees planted around a farmstead to provide protection from the wind.

Need.—With almost constant northwest winds blowing throughout the winter months and with only one-fifth of the original protective forest growth remaining, there is serious need for planting to protect Illinois farmsteads from winds. This is true particularly in the sections of intensive agriculture, where differences in elevation are not sufficient to break the force of the wind and where most of the tree growth has been cleared to make way for annual crops. From 1870 to 1875, considerable interest in windbreak planting was evidenced in the northern part of the state, and the early plantings that were given good care and protection now stand as landmarks, the better evergreen windbreaks having reached heights of 60 feet.

The trees used in early windbreaks were mostly of European origin, and it was not always easy to obtain good planting stock. Today, with numerous private tree nurseries throughout the state producing large quantities of trees suited for windbreak planting, more farmsteads could easily be provided with wind protection at very little cost.

Benefits.—The greatest benefit that can be expected from a good windbreak is the sheltering effect on the farmhouse, the farm buildings and the feedlots, fig. 1. A house protected by a windbreak is more comfortable in winter, and less costly to heat, than one lacking such protection. On wash days, even when the biting winter winds are howling down out of the north, clothes can be hung in the protection of the windbreak with little discomfort. Windbreak-protected barns and feed sheds are warmer in winter and keep more nearly even temperatures, so that livestock can be more easily carried over winter in good condition. Also, livestock can make more winter use of protected feedlots. For men working around feedlots and barns the windbreak pro-

*Extension Forester, Illinois Natural History Survey and University of Illinois College of Agriculture, cooperating.

vides comparative comfort in the zone of quiet air to the leeward of its spreading branches.

With its contribution of beautiful form and color, as well as comfort, the windbreak can make a farm home out of a farm-

Fig. 1.—Farmstead in southeastern Henry County, facing south. Upper: Protective strips of trees are on the north and west sides. Lower: Feed shed and feedlots of this farmstead are well protected by a 28-year-old windbreak of Norway spruce.

house. When the farmstead is protected by a windbreak, flowers, shrubs and ornamental trees have a better chance to develop, and beautification of the home grounds is more easily achieved. Windbreaks catch winter snows and if properly located prevent their blocking walks and drives, and piling up around buildings. Snow under the shade of the trees melts slowly in the spring, and the moisture is conserved for garden crops and small fruits planted near the windbreak.

PLANNING THE WINDBREAK

Species of Trees to Use.—Evergreen trees provide the most satisfactory windbreak because they hold their foliage during the winter months when protection is most needed. The spruce and fir form an almost solid barrier to the wind because of their

dense-branching habit and their tendency, if given plenty of growing room, to hold heavy foliage on branches close to the ground. Of this group the Norway spruce and the Douglas fir are best adapted to Illinois conditions. Norway spruce is suited to the northern two-thirds of the state. Douglas fir, from the dry Rocky Mountain region, is more drought resistant and is adapted to a wider range of soils.

Pines make more rapid height growth than spruce or fir, but, because their branching habit is more open and their foliage thinner, they do not break the wind so effectively. To attain height in a windbreak at an early date, pine may be used as a center row between two outer rows of spruce or fir. Pine should not be used alone, except on light, sandy soils to which the other trees are not adapted. Four pines—Norway pine, white pine, shortleaf pine and Austrian pine—may be used for windbreaks. The shortleaf pine is a southern tree, native to lower Illinois, and should be used only in the southern third of the state. The other three may be used throughout Illinois.

Another evergreen, the red cedar, is occasionally used for windbreaks. It is rather short and comparatively slow growing, but it has very dense foliage and is pleasing in appearance (frontispiece).

It is advisable to use more than one species of tree in the windbreak to prevent the severe appearance of straight rows of trees all of the same form and color, and to make the windbreak blend into the farmstead landscape scheme. Spruce or fir may be used for the foundation of the windbreak, but the solid rows should be broken with small groups of evergreens having foliage of different texture, color and form. Such groups at the ends and in corners are particularly pleasing in appearance. The windbreak spacing is not changed; the other varieties simply replace the spruce or fir in the regular spacing. Some trees that may be used in this way without lessening the effectiveness of the windbreak are blue spruce, white spruce, red pine, Austrian pine and Scotch pine.

Size and Sources of Planting Stock.—Quickest results and greatest success can be expected from using fairly large planting stock. If low cost is an important consideration, bare-root trees may be used, but these should be transplant trees at least 4 years old. They will vary from 12 to 15 inches in height of top and are usually designated as 2-2 transplants, having been grown 2 years in the seed bed and 2 years in the transplant rows. Extreme

care is necessary in handling bare-root trees to assure satisfactory results.

Better results can be expected by planting the windbreak with balled-and-burlapped trees, fig. 2, trees that have been dug with a ball of earth on the roots and this ball wrapped securely

Fig. 2.—Balled-and-burlapped tree of size recommended for windbreak planting. This tree has a ball of earth large enough to insure its being handled without disturbance to the root system.

in burlap. Trees handled in this way never have the roots exposed to the air, and, if carefully handled, the soil is not even loosened from the fine feeding roots. Of the balled-and-burlapped trees, those 2 to 4 feet high are the most convenient to handle.

Windbreaks generally require 100 to 150 trees, varying, of course, with the length necessary to protect buildings and lots. (See "Number of Rows and Spacing," page 7.) It is advisable to purchase at least 10 more trees than are actually needed, so that some extra trees may be planted in the garden and used later to replace losses in the windbreak.

The majority of ornamental nurseries grow the types of trees satisfactory for windbreaks, and some of the large nurseries specialize in producing windbreak trees. Information on sources and prices of windbreak planting stock may be had by writing to the Extension Forester, 220 New Agriculture Building, Urbana, Illinois.

Trees should be ordered early in the winter to assure obtaining those desired before supplies run out.

Locating the Windbreak.—For nearly all of Illinois, the prevailing winter wind is from the northwest, fig. 3, and the wind-

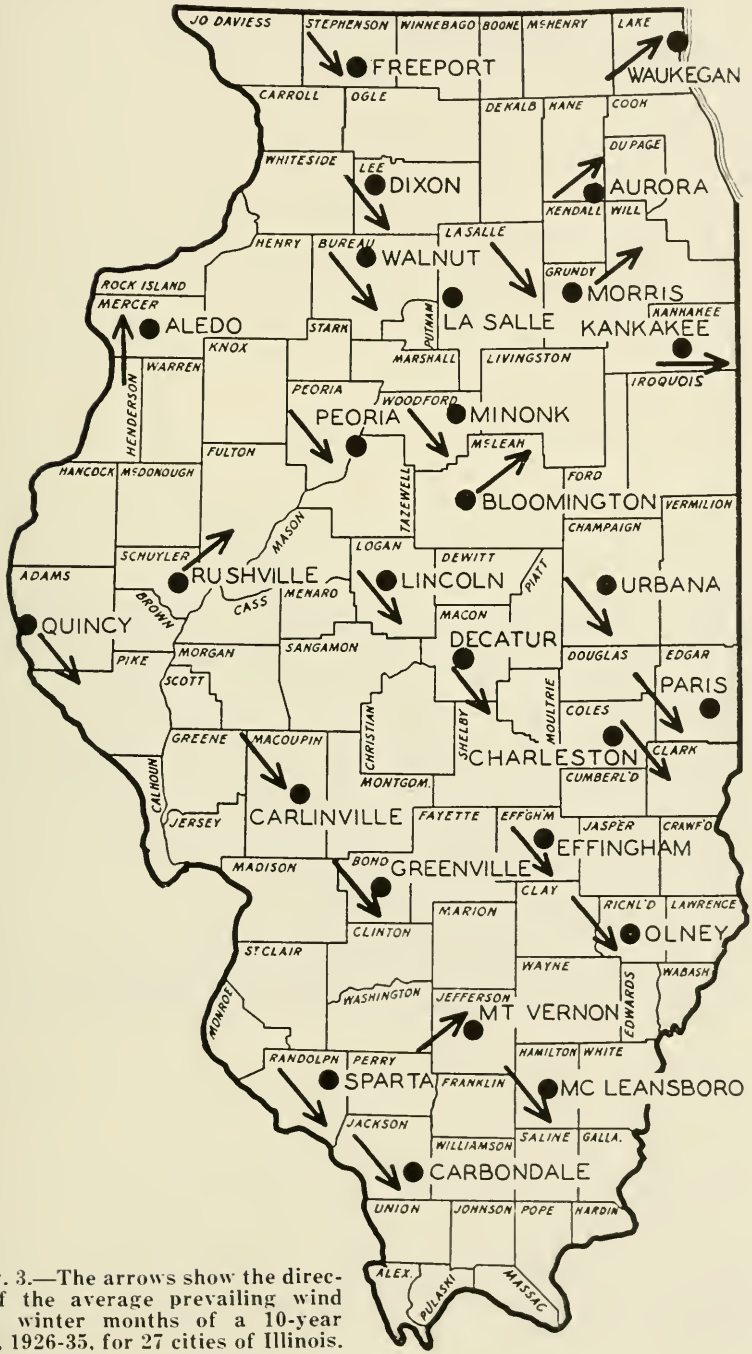


Fig. 3.—The arrows show the direction of the average prevailing wind during winter months of a 10-year period, 1926-35, for 27 cities of Illinois.

break, to give the best protection, should be located on the north and west of the farmstead. Even in those few localities in which the prevailing wind is southerly, it is not advisable to place a windbreak on the south of the farmstead, for in these localities the coldest winds are from the north and northwest. It must be remembered, also, that the prevailing summer winds are southwest, and it is desirable to have the farmstead exposed to the south to receive the cooling effects of these winds. In localities where the prevailing winter wind is south or southwest, it is advisable to run the north-south line of the windbreak at least 100 feet farther than usual to the south of the farm buildings, but the windbreak should never be planted on the south side of the farmstead.

The most effective and most easily arranged windbreak is in the form of an L, fig. 4, with the point to the northwest. The legs

Fig. 4.—A recently planted L-shaped windbreak in McHenry County. This arrangement is most effective in protecting farmsteads from prevailing winds.

of the L may be broken to make way for farm lanes, but the windbreak should not be broken near the corner where northwest winds may sweep through directly to the buildings.

Figs. 7 and 8 show windbreak plans for farmsteads facing the cardinal points of the compass. These plans are for typical farmsteads found in Illinois, but are set up only as guides for the prospective windbreak planter. Because of the unlimited ways

in which farm buildings are arranged, nearly every farmstead presents a different problem in the planning of the windbreak. If the principles recommended in this circular are followed in planning the windbreak, it should be possible to provide satisfactory protection for any type of farmstead arrangement.

Farmsteads facing south or east, fig. 7, are the easiest for which to plan windbreaks. Those facing west or north, fig. 8, present more difficult problems, because of the necessity for shutting out completely the front outlook of the house, if the best protection is to be had. Most Illinois farm homes are built so close to the road that there is not room enough to plant a solid windbreak between the front of the house and the road. Usually, in homes facing west or north, it is necessary to sacrifice part of the efficiency of the windbreak and part of the outlook, and make the short leg of the L only a single row of trees extending whatever distance is desired across the front of the property.

If a farmstead faces north or west, and it is desired not to obstruct the view at all from the front of the house, the windbreak can then take only the form of a straight line running along the west or north side of the farmstead.

Distances From Buildings.—Effective protection is afforded by a good windbreak to a distance approximately eight times its height. Thus, a windbreak 40 feet high should almost completely check the wind for 320 feet to leeward, and buildings and lots in this area should have adequate protection. Some influence of the windbreak may be felt at a distance up to 20 times the height of the trees, but in Illinois it is best to keep principal buildings within a 300-foot distance.

To prevent dead-air pockets around buildings in summer, and to minimize the piling of snow on buildings and walks in winter, the windbreak should be set not closer than 50 feet from buildings, and 100 feet is a better distance if room is available. Where possible, the end of the windbreak should extend at least 50 feet past the line of the last building to be protected.

Number of Rows and Spacing.—For the species of evergreens previously mentioned, the best type of windbreak consists of three rows of trees, the trees in the middle row being alternated with those in the two outside rows, fig. 6. The rows should be at least 14 feet apart and the trees should be spaced 14 feet apart in the rows. With this spacing, when three rows are used, three trees are required for every 14 feet of windbreak; the planting rate is one tree per 4.6 feet. A 600-foot windbreak will

require 150 trees. *Trees should not be planted close together to form a hedge*, fig. 5, for evergreens need plenty of room and light to develop dense lower branches, and the lower branches are

Fig. 5.—A well-spaced windbreak being planted in De Kalb County. These trees were trucked from the nursery on the planting day and were out of the ground only a few hours.

needed to check surface winds when the trees start making good height growth.

To avoid difficulties in laying out the corner of the windbreak, follow the plan shown in fig. 6. First stake out one strip of the windbreak *for its entire length*, the three rows indicated by *A*. Then lay out the outer row of the second strip, the trees indicated by *B*, in line with the trees nearest the letter *A* in the outside rows of the first strip. In staking out the first row in the second strip, begin 12 feet from the nearest tree in the inside row of the first strip. The middle row of the second strip will then start 19 feet from the inside row of the first strip.

PLANTING THE WINDBREAK

Preparation for Planting.—All plans for the windbreak should be made in the fall, and the area should be marked out. Included in the area should be a strip at least 6 feet wide between the outer rows and a fence that should be erected to protect the

trees. Experience in Illinois indicates that it is advisable to maintain a sod cover on the windbreak area; so soil preparation will be necessary only where a satisfactory sod does not already exist. Where plowing of the windbreak area is essential, this should be done thoroughly in the fall and followed by disking and harrowing in the spring.

Since windbreaks are located to protect barns and feedlots, as well as houses, there may often be a drainage of barnyard water across the windbreak area. Such drainage will kill evergreens in a short time and should be taken care of before the trees are planted. The barnyard water may be carried around

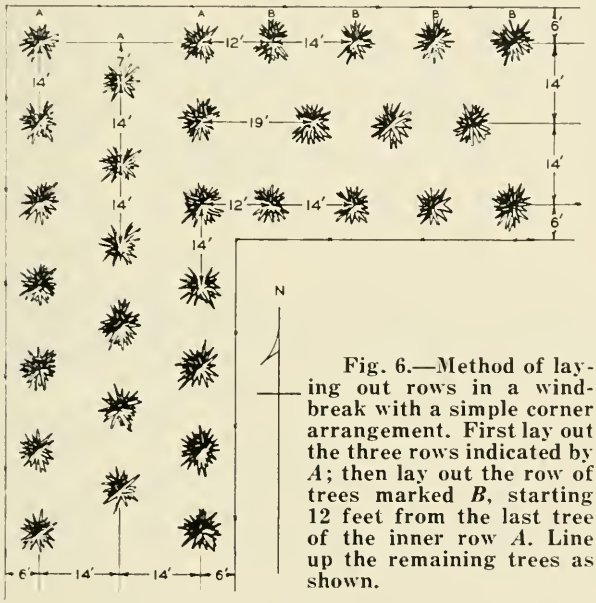


Fig. 6.—Method of laying out rows in a windbreak with a simple corner arrangement. First lay out the three rows indicated by *A*; then lay out the row of trees marked *B*, starting 12 feet from the last tree of the inner row *A*. Line up the remaining trees as shown.

the windbreak by a ditch, or through it by a ditch or tile. The diversion ditch is preferable.

It is more convenient to build necessary fences around the windbreak area in the fall than to postpone this job until the trees are planted, when the fencing might be neglected because of the rush of spring work. The fence must be adequate to keep out both stock and poultry, and should be at least 6 feet from the rows of trees, fig. 6.

Only spring planting of windbreaks is recommended. Spring-planted trees have the advantage of one growing season before

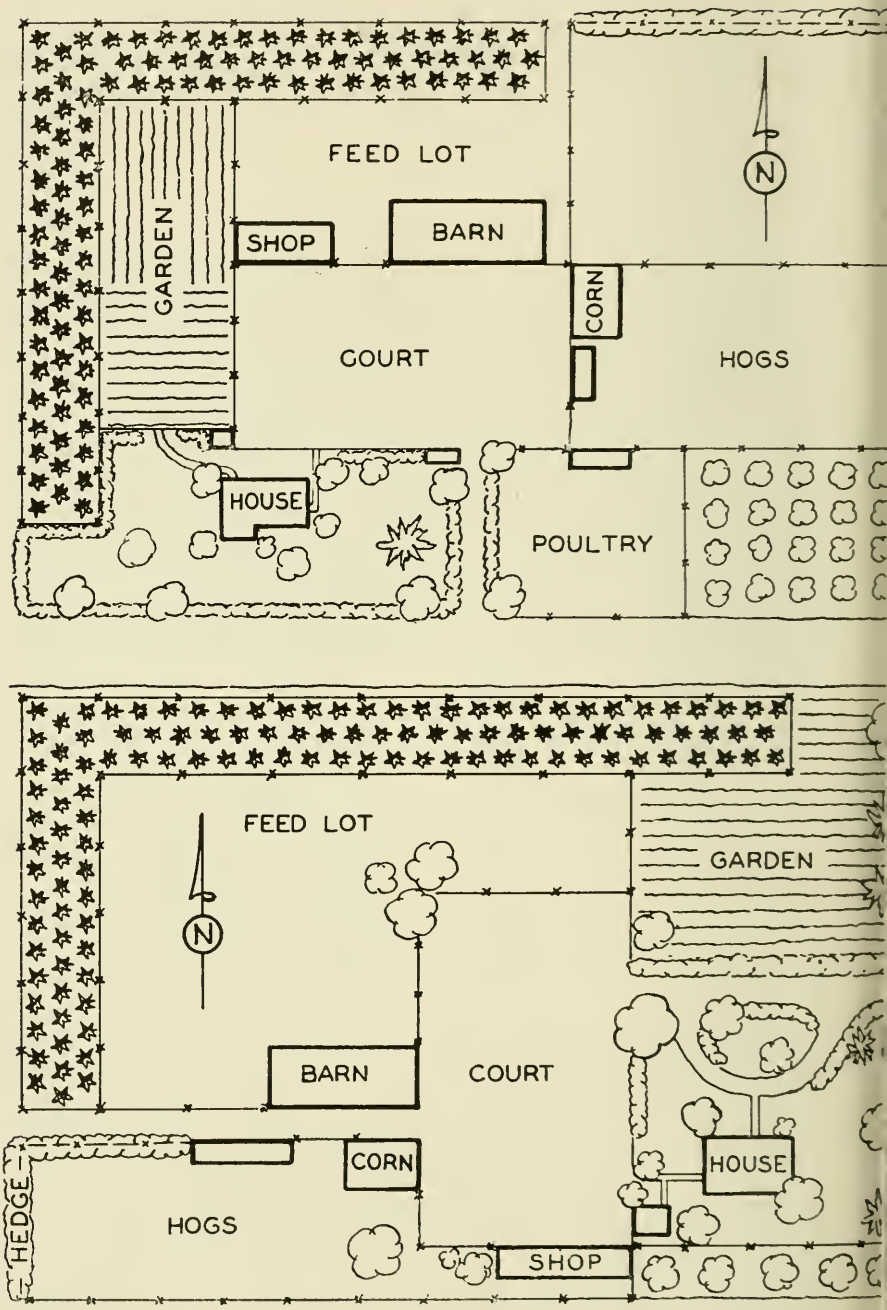
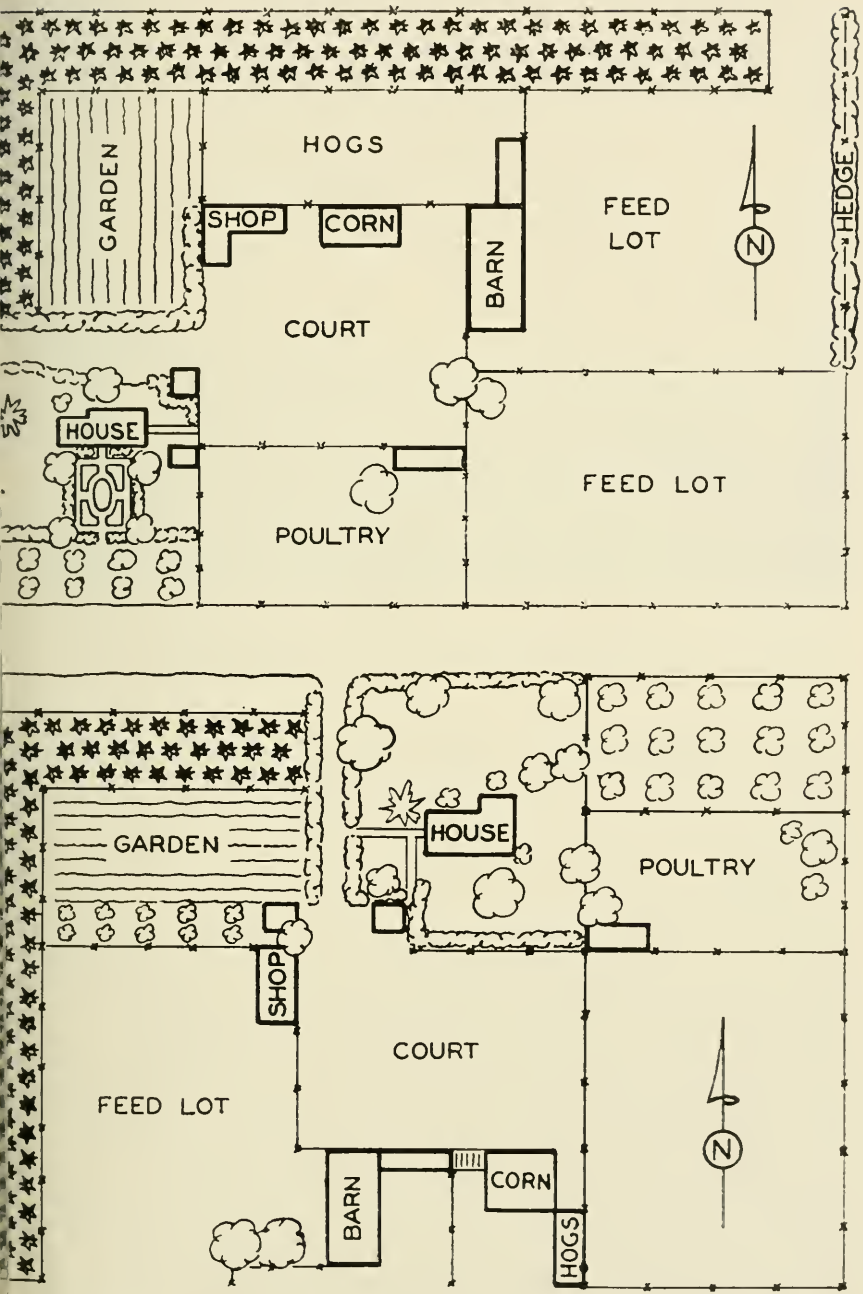


Fig. 7.—Plan for windbreak for farmsteads facing (above) south; (below) ea



—Plan for windbreak for farmsteads facing (above) west; (below) north.

they encounter the rigors of their first winter. Fall-planted windbreaks may suffer heavy losses from frost heaving or winter burning, and the average farmstead owner cannot afford to lose a large number of trees of the size used for windbreak planting.

Fig. 9.—Windbreak area in Putnam County well prepared and ready for the trees. Lath stakes indicate where the trees are to be planted.

In the spring, each row should be laid out and the place for each tree marked with a stake. Laths make handy markers for this use, fig. 9. It is important that the area be ready so that planting may be done without delay as soon as the trees are received.

Handling the Trees.—Nurseries will ship you trees at the time you request. When your order is confirmed you should notify the nursery of a shipping date that will bring you the trees at a time when in your experience you know the ground will be in good condition; the earlier in the spring the better.

Bare-root trees will usually be shipped by express. After receiving notice of the shipping of your trees, telephone your express office daily so that you can call for the trees as quickly as possible after their arrival. Bare-root trees of the size suitable for windbreak planting are usually tied in bunches and packed tightly in crates or burlap-covered bundles with the roots in moist moss. The moss is necessary to keep the tree roots moist, but if left very long it will heat and may seriously damage the trees.

Not only should you take the bare-root trees from the express

office as soon as they arrive, but when you take them to the farm you should immediately unpack and heel them in. By heeling in is meant placing the trees in a straight trench and packing the soil firmly around the roots to keep them moist. Make a trench 10 to 12 inches deep and long enough to contain the trees placed side by side in a single row. Dig the trench with one side of it slightly sloping; when removing the soil pile it on the other side so that you can easily throw it over the roots after you have placed them in the trench. Before opening each bunch of trees, cut off any long, straggling roots, as roots curled up in the bottom of the planting hole or turned back toward the top cannot grow properly. After pruning the straggling roots, open the bundles and spread the trees along the sloping side of the trench; replace the soil and pack it about the roots of the trees.

Do not take the bundles of trees from the moist moss until the trench is prepared. *Use care at all times to keep the roots of the trees moist.* Drying of the roots will kill them; it is improper handling of the trees that causes many serious plantation losses. After heeling in the trees, water the soil about the roots and keep it well watered until all trees are planted. The trees should be heeled in in a shady place, or should be shaded with boards or burlap set high enough off the ground to allow free circulation of air around the tree tops. The trees may be kept heeled in for a week or 10 days, but best results can be expected if they are planted in the windbreak area at once.

When planting bare-root trees, carry them in a galvanized bucket or tub containing sufficient water to cover the roots. The water will serve to keep the roots moist while the trees are being carried along the rows. Take trees from the bucket one at a time; do not remove a tree from the bucket until the hole for it is prepared. Do not carry bare-root trees in your hand along the planting row, for a few seconds exposure will kill the fine roots.

Balled-and-burlapped trees are considerably heavier than bare-root trees and cannot be shipped very far without excessive transportation costs. These costs may sometimes be reduced if the trees can be called for at the nursery by truck.

In handling balled-and-burlapped trees, be careful not to break the ball of earth. Breaking this ball will tear away fine feeding roots; also, the loosened earth will dry out quickly.

Balled-and-burlapped trees need not be heeled in, but should be grouped together in a shady place and the balls of earth prevented from drying with wet gunny sacks or tarpaulin.

Planting.—Where a sod cover exists on the space set aside for the windbreak, it is necessary to cut away an area of sod at least 4 feet in diameter where each tree is to be planted. The hole in which the tree is planted should be wide enough and deep enough to accommodate the roots well spread out in a natural position, or to receive the ball of earth without crowding, and to allow the tree to be set at least as deep as it grew in the nursery. Planting the tree as much as an inch deeper than it grew in the nursery will do no harm, but it should never be planted any shallower.

The mattock, or grub hoe, is the most convenient tool to use for cutting away sod. The round-pointed shovel has been found most satisfactory for digging holes, although various types of spades also may be used.

In planting a bare-root tree, hold the tree in an upright position and work the soil down around the roots, tamping it in firmly until the hole is about three-quarters filled. In planting a balled-and-burlapped tree, set the ball in the hole *without removing the burlap*, fig. 10, and tamp top soil around the ball until the hole is about three-quarters filled.

Before filling the hole of the bare-root or the balled-and-burlapped tree, pour in at least one bucket of water and let it soak in, fig. 11. Do no more tamping after watering. Fill the hole level with the ground surface with loose soil; do not make a mound around the base of the tree. In planting a balled-and-burlapped tree, before the hole is completely filled with soil. loosen the burlap from the top of the ball and spread it out to be covered with a mulching material.

When planting windbreak trees, observe these precautions:

Don't allow tree roots to become dried in handling.
Don't make the hole so shallow that the roots will have to be curled up or bunched.
Don't set the tree in a leaning position.
Don't set the tree more than an inch deeper than it grew in the nursery, and never any shallower.
Don't put dry soil, sod or other debris in the bottom of the hole.
Don't neglect to pack the soil around the roots of the tree.

CARE OF THE WINDBREAK

Protection.—Windbreaks, to be successful, must be protected from both stock and poultry throughout their entire lives. As stated above, adequate fences, fig. 12, should be built *even before the trees are planted.*

Animals pack the soil and injure tree roots; they browse

Fig. 10.—Balled-and-burlapped Norway spruce set in windbreak row without removing burlap from ball of earth. The cords will be cut and the burlap turned back from the top of the ball before the hole is completely filled with soil.

Fig. 11.—Watering a newly planted Norway spruce after the hole has been three-quarters filled with soil.

and trample the trees when small, and spoil the effectiveness of larger trees by browsing the foliage and by breaking the lower branches. Poultry scratch earth away from the roots and pick the opening buds in the spring; when they roost in trees their droppings kill the branches. In some situations protection from rabbits may be necessary, but usually no special protection from these animals is necessary if the fence is poultry tight.

Mulching.—A good mulch should be placed around the trees immediately after planting and this mulch should be maintained until the lower branches of the trees cover the area normally

Fig. 12.—The fence is important in windbreak planting. This young windbreak in Vermilion County is well protected from livestock by a good fence.

covered by the mulch. Peat moss, straw or ground cobs make good mulching material. Straw is commonly used as it is usually available and is easy to handle, fig. 13.

The mulch should cover an area not less than 4 feet in diameter and should be at least 3 inches thick. As soon as the mulch breaks down so that weeds start growing through, it

should be replaced. The mulching material should not be placed against the tree; an open area should be left around the stem to reduce the possibility of mouse injury.

Cultivation.—Establishing a good sod cover between the trees and maintaining a good mulch around the trees have been found more satisfactory than cultivating the windbreak.

Fig. 13.—Straw mulch placed around Douglas fir tree in windbreak on the University of Illinois Experiment Field in Fayette County has been completely effective in keeping weeds and grass away from the tree.

In case homestead owners desire to grow garden crops in the windbreak area, cultivation is not objectionable if kept far enough away from the trees to avoid disturbing the mulch. Any row crops may be grown, but vining crops should be avoided. The cultivation of garden crops in the windbreak should not be carried on for more than 3 years after the trees are planted, as the roots of the trees will begin to spread out where they will be liable to injury by the cultivator.

In establishing a sod cover, use any grass mixture suited to the locality. Mixtures, including clover or lespedeza, are desirable, but *sweet clover and alfalfa should be avoided.* After the sod is established, usually about two clippings a season are advisable to reduce competition with the trees.

Replanting.—The success of a windbreak depends on a solid stand of trees being brought through to maturity. Each tree missing from the original pattern cuts down the efficiency of the windbreak and lessens the planter's reward for his efforts in setting and caring for the trees. The planter cannot expect

Fig. 14.—A Norway spruce windbreak, 65 years old and beginning to thin out; badly in need of supplemental planting.

every tree to live, and there are usually a few losses during the first few years. This is why it is advisable to order at least 10 more trees than will actually be needed to plant the windbreak. These trees should be set about 3 feet apart in a row in the garden, cared for as are the windbreak trees and used to replace the windbreak trees that die. There should be no further losses in the young windbreak after it is 5 years old, and any remaining replacement trees may be used for ornamental planting about the grounds.

Renewing Old Windbreaks.—Evergreen trees, like other living plants, will not live forever, and the time must be expected when the trees in the mature windbreak will start dying. Then the windbreak will begin to lose its effectiveness. Many of the old windbreaks planted in northern Illinois in the 1860's and '70's have served well for many decades but are now becoming thin and ineffective, as is shown clearly in fig. 14. The life span of the evergreens is usually longer in northern Illinois than in the southern or central parts of the state, and on the Grand Prairie their life span is shortest. The windbreaks planted today, however, should last much longer than the old windbreaks have lasted, since in the early plantings the trees were invariably set too close together and their greatest loss has been the result of overcrowding.

As soon as an old windbreak starts thinning out, steps should be taken to get new trees established so that these trees will be

tall enough to be effective by the time the old trees have to be removed. The best plan is to start two new rows of trees outside the old windbreak, as was done in the case illustrated in fig. 15. When the old trees finally have to be cut, a third row of new trees may then be set where the old windbreak originally stood. If it is desired to work the windbreak in closer to the farmstead, the first two rows of new trees can be set on the inside of the old windbreak rather than on the outside. New trees should never

Fig. 15.—Two new rows of Norway spruce planted to supplement an old windbreak that is thinning out.

be planted among the old ones, for the evergreens need full light for their development and will be quickly killed by the shade from the old trees.

Diseases and Insects.—The trees in the windbreak should be watched for symptoms of injury by disease or insects, for such injury may seriously retard the growth of the trees, or even kill some of them. At present there are no pests which have become serious in Illinois on the trees recommended for windbreak planting, with the exception of the tip moth, which attacks shortleaf pine.

It is advisable to look over the trees occasionally and, whenever any symptoms of disease or insect injury appear, immedi-

ately send specimens of the injured branches to the Natural History Survey, at Urbana, for identification and recommendations for control measures. Quick action may save considerable loss.

Expectations.—Some persons feel that evergreens make slow growth; they would rather plant trees which make a showing

Fig. 16.—A Norway spruce windbreak in McLean County. Protected from stock and poultry by a good fence, the trees in this windbreak in 18 years have reached a height of 20 feet.

more quickly. In truth, the trees that are considered fast growing are weak, subject to ice and wind damage and do not make satisfactory windbreaks. After all, the valuable trees adapted to Illinois climates are comparatively slow growing; there is a tendency among persons not well acquainted with trees to expect too much of them. See figs. 16 and 17.

Patience in caring for an evergreen windbreak will be well rewarded, for its protective influence will last several generations. Evergreen windbreaks planted in northern Illinois 65 years ago now stand 60 to 70 feet high and have been affording good protection for more than 45 years. A Norway spruce windbreak planted 18 years ago in the southeast corner of Hamilton County has reached a height of 30 feet. Its branches form an almost impenetrable barrier to the wind. Another Norway spruce windbreak planted 12 years ago near Greenville in Bond County averages 18 feet in height. Most of the windbreak trees may be expected to make an average growth of 1 foot per year throughout their lives. For the first 20 years some trees may grow as much as 3 feet a year, variations in growth depending on seasons and on soil and moisture conditions. On the Grand Prairie, none of the evergreens should be expected to make as good height

growth nor to maintain as dense foliage as they do in other sections of the state. In this area, spruce exceed the pines in height and do not flatten out as do the pines.

WHAT THE WINDBREAK TREES ARE LIKE

Norway Spruce (*Picea excelsa*).—A native of Europe which has been found well adapted to planting in North America. Makes good growth throughout most of the state of Illinois but will not develop on sandy or excessively dry soils. Develops a tall conical crown with the branches tending to sweep downward and then turn slightly upward at the ends. The twigs often hang down like streamers from the lower branches, fig. 18. The leaves

Fig. 17.—This farmstead in Jo Daviess County enjoys the protection of a 60-year old Norway spruce windbreak.

are short, needlelike and rich dark green. Grows best on deep, fresh soils. See figs. 16, 17 and 19 as well as fig. 18.

Douglas Fir (*Pseudotsuga taxifolia*).—A native of western North America found growing under a wide variety of conditions. The type found growing in the dry central Rocky Mountain region is well adapted to planting in Illinois and has been found to be drought resistant. Develops a dense pyramidal crown, with lower branches sweeping downward, similar to the Norway spruce. The densely leaved twigs, also, sweep downward from the branches, giving an exceptionally attractive appearance to the tree. The leaves are needlelike, averaging 1 inch in length, and, although normally dark green, they may often have a blue tinge.

White Spruce (*Picea glauca*).—A native tree of the north woods of the northeastern United States and Canada that has been used successfully in ornamental plantings in Illinois. It

does not grow so fast as Douglas fir or Norway spruce, but it has a dense, bluish-green foliage that is useful for windbreak plantings and that gives pleasing ornamental effects. Black Hills spruce (*Picea glauca albertiana*) is a variety of white spruce from the Black Hills of South Dakota. This variety is exceptionally drought resistant, but it grows too slowly to be generally recommended for windbreak planting in Illinois.

Colorado Blue Spruce (*Picea pungens*).—A native of the Rocky Mountains well adapted to Illinois conditions. Highly desirable in the blue form as an ornamental tree because of the light bluish cast and denseness of the foliage. Drought resistant, but slow growing. An excellent tree to mix with Douglas fir or Norway spruce for pleasing landscaping effects.

Norway Pine or Red Pine (*Pinus resinosa*).—A native tree of the forests of the Great Lakes region and northeastern United States which is doing exceptionally well in plantations in Illinois, even on dry, sandy soils. Makes rapid growth and attains good height. The reddish color of the bark and the sturdy, upright form of this tree add to the beauty of an evergreen planting. The needlelike leaves are long, but being borne in clusters of two leaves each do not make as dense foliage as spruce or fir. This, as well as the other pines, may be planted as the center row of a spruce or fir windbreak, but should not be used alone except in the sand regions where conditions are too dry for spruce or fir. The Norway pine is particularly free from insect pests and also from diseases.

Fig. 18.—Interior of Norway spruce windbreak, showing density of foliage. The trees in this windbreak in southern Hamilton County have averaged 30 feet in height growth in 12 years; they illustrate the adaptability of Norway spruce to southern Illinois.

White Pine (*Pinus strobus*).—A native tree of northern Illinois commonly found as a dooryard tree throughout the state. Well adapted to a wide variety of soils, but will not stand dry conditions so well as Norway pine or Austrian pine. This tree

Fig. 19.—Red cedar and Norway spruce combined in a windbreak. The two kinds of trees are the same age, but the Norway spruce in the background is twice as tall as the red cedar in front.

makes comparatively fast growth and reaches greater height than the other evergreens, except on the Grand Prairie, where the top tends to flatten out. The dark green, needlelike leaves, borne five in a cluster, are fine and limber, and form a denser foliage than that of the other pines.

Shortleaf Pine (*Pinus echinata*).—A native pine of southern Illinois found on the dry ridges of the Ozarks. Grows very rapidly and is well adapted to planting in poor, dry soils. The needlelike leaves, borne two or three in a cluster, do not make a dense foliage. This tree is useful principally because of its rapid growth, but should be planted only in the southern part of the state.

Austrian Pine (*Pinus nigra*).—A native of Europe which was widely planted in Illinois as a dooryard tree in the late years of the last century. The needlelike leaves are long and dark green, and form a fairly dense foliage. Makes rapid growth and will develop on poor, dry soils. It is free from insect pests and diseases, and its usefulness for windbreak planting is much the same as that of Norway pine.

Red Cedar (*Juniperus virginiana*).—A native evergreen of Illinois with short, needlelike and scalelike leaves, and a very dense branching habit. It does not make great height growth, seldom reaching a height of 40 feet, but is adapted to practically all soils. Because of its dense crown it is useful where there is

room for only a single row of trees. The red cedar harbors the cedar apple rust, which may cause serious damage to its alternate host, the apple. It is therefore not recommended for use in apple regions, even though orchardists may grow rust-resistant varieties of apples. See the frontispiece for red cedar windbreak and fig. 19 for windbreak of red cedar and Norway spruce.

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